

Remarks

This amendment responds to the Advisory Action mailed May 17, 2006. Claims 1-7 are pending for reconsideration.

Rejections Under 35 U.S.C. §103

Claims 1-7 stand rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 6,828,245 to Chang, hereafter Chang, in view of U.S. Patent 6,319,821 to Liu et al., hereafter Liu. Applicants respectfully traverse these rejections for at least the following reasons.

Chang and Liu neither disclose nor suggest the claimed aspects of the present invention, “forming an upper metal line contacting the lower metal line by filling the upper metal line region,” recited in independent claim 1.

As disclosed in the specification of the present application, the anti-reflection film [Fig. 3d: 53] and the third interlayer insulating film [51] are etched using the photoresist pattern [59] as a mask to form [Page 10, lines 2-5] the upper metal line region [61]. Edge portions of the anti-reflection film [53] and the second etch barrier film [49] in the upper metal line region [61], which are denoted as “C” in Fig. 3e, are not etched [Page 10, lines 12-15]. Thereafter, the upper metal line region [61] is filled to form an upper metal line [Page 10, lines 16-17].

In contrast, Chang’s upper metal line does not contact a lower metal line because an etching stop liner [Fig. 2F: 32] remains on the conductive area [22B] when the dual damascene opening is formed [col. 6, lines 3-15]. Thus, Chang is able to form an upper conductive layer filling the dual damascene opening on top of the etching stop liner [32]. Unlike the structure of the present invention, Chang does not provide an upper metal line “contacting” a lower metal line due to the presence of a stop liner between the upper [30] and lower [22B] lines.

Liu forms [col. 8, lines 58-59] a dual damascene metal interconnect [Fig. 11: 88] by depositing metal [col. 8, lines 60-61] above a lower etch stop layer [60]. Unlike the present invention, Liu does not remove any of the stop layer, thereby ensuring that the upper and lower metal lines are not in contact. Thus, Liu clearly lacks the limitation of “removing the exposed portion of the first etch barrier film to expose the lower metal line” found in independent claim 1 because no portions of Liu’s lower etch stop layer [60], corresponding to the first etch barrier film, are removed.

As amended, independent claim 1 now recites a step of “removing the photoresist film pattern to expose the lower metal line.” This limitation clearly defines over the Chang and Liu patents, describing how removal of the photoresist film pattern [Fig. 3c: 59] results in exposure of the lower metal line [Fig. 3e: 41], thereby permitting the upper metal line to directly contact the lower metal line, as recited in claim 1. In contrast, Chang’s lower metal line [Fig. 2F: 22B] is covered by a etching stop liner [32] after removal of the via plug [Fig. 2E: 34] and the photoresist layer [Fig. 2E: 28C]. Liu does not remedy Chang’s deficiencies, because the removal of Liu’s photoresist layers [Fig. 9: 84/86] only results in exposure of a stop layer [Fig. 10: 60], failing to expose a lower metal line as claimed.

For at least the above reasons, it is respectfully submitted that Chang and Liu do not render obvious all of the limitations. Thus, the rejection under 35 U.S.C. §103(a) of independent claim 1 should be withdrawn. Moreover, claims 2-7 depend, either directly or indirectly, from independent claim 1 and therefore recite the same allowable combination of features and additional features that further distinguish them over the applied prior art.

Conclusion

In view of the foregoing, Applicants respectfully request that a notice of allowance be forthcoming. The Examiner is invited to contact the undersigned for any reason related to the advancement of this case. The Commissioner is authorized to credit any over payment or charge any deficient to deposit account number 08-1641.

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